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(54) **Thermally insulated building block**

(57) A masonry unit comprises a cementitiuos portion to at least one face of which is secured a thermally insulating panel. The cementitious portion may be of dense, lightweight or aerated concrete and may be solid, cellular or hollow. The thermally insulating panel is preferably of expanded or extruded polystyrene, but may be of fibrous or cellular material. The panel may be secured to the cementitious portion by means of an adhesive, by means of double sided adhesive tape or by one or more mechanical keys 13, 14. Units 3, 4 are held together by mortar 5 which fills the V shaped recess 6 formed by chamferring of the edges of the insulating panels and thereby helps to hold the panels in place.

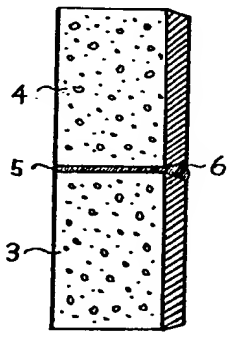

FIG. 2

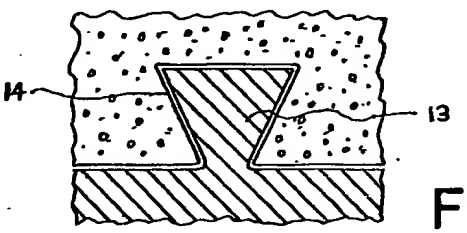

FIG.4A

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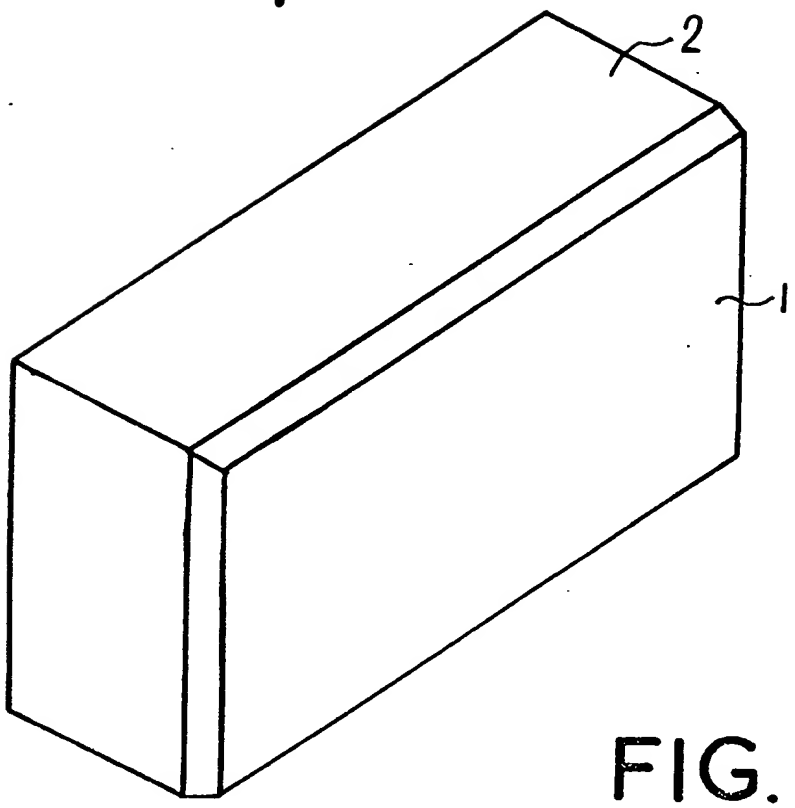

FIG. 1

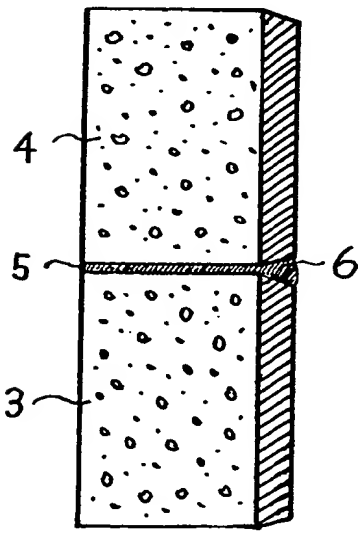

FIG. 2

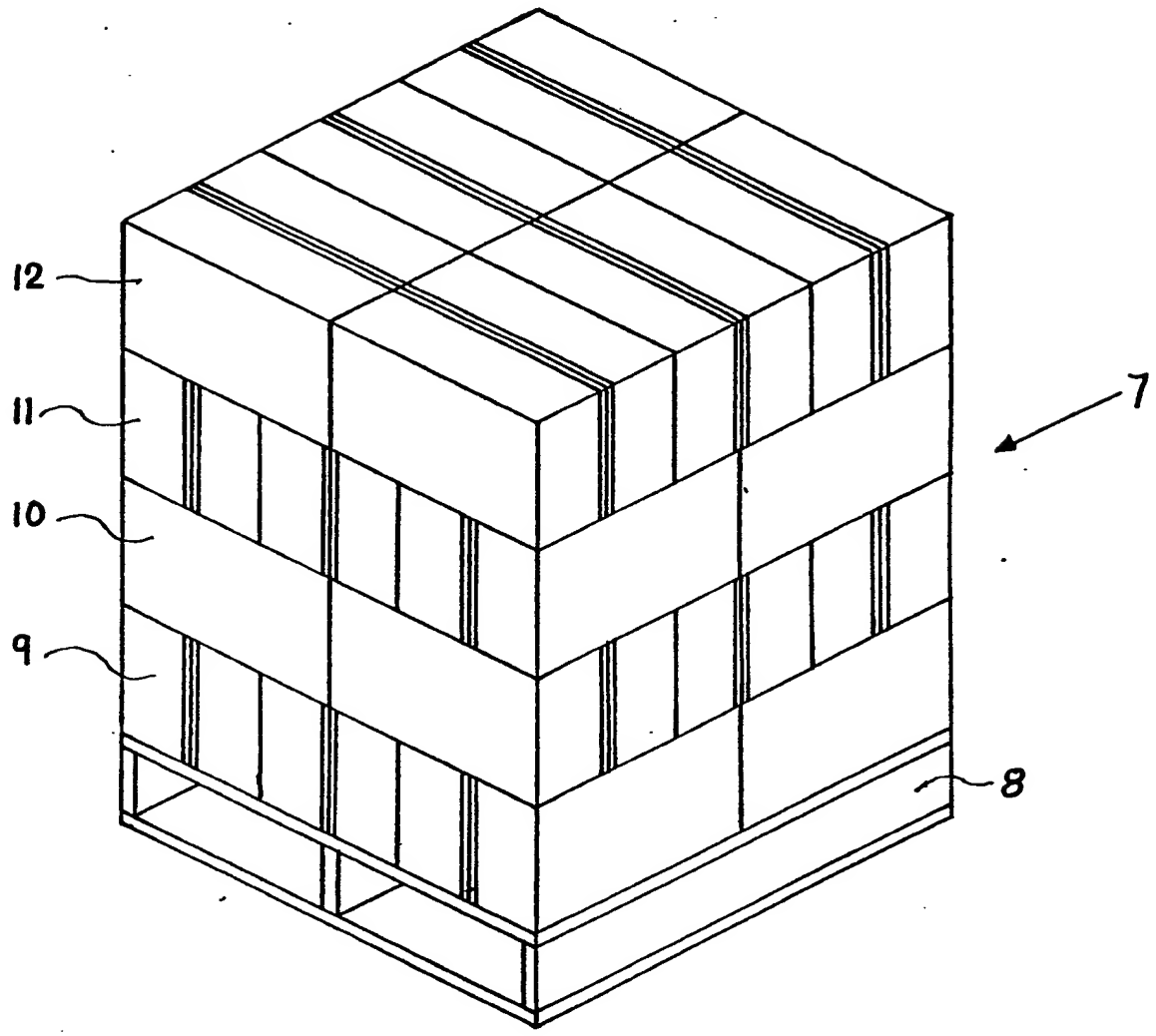

FIG. 3

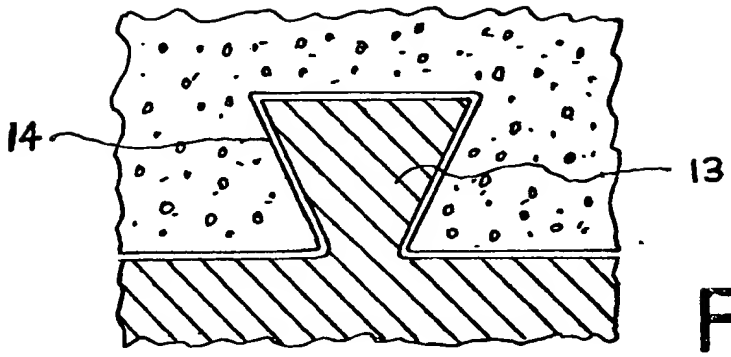

FIG.4A

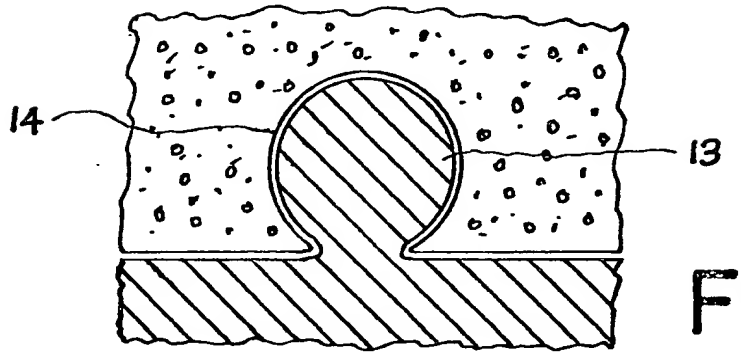

FIG.4B

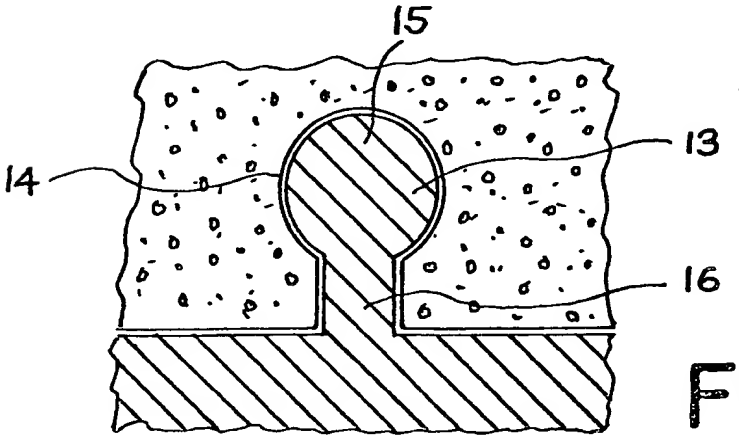

FIG.4C

SPECIFICATION

Thermally insulating masonry units

This invention concerns thermally insulating masonry units and is especially concerned with masonry units consisting predominantly of cementitious material.

In order to improve energy conservation increasingly stringent regulations are being introduced to ensure that buildings erected for human occupation are constructed of such materials that loss of heat is minimised. A particularly important route by which heat passes from the inside of a building to the outside atmosphere is by conduction and convection through the walls. Even when the outside walls of a building are constructed in the form of an inner and an outer leaf with a cavity of appropriate width between the two leaves, the loss of heat by conduction and convection through the walls is unacceptable when the two leaves are constructed of conventional cementitious or burnt clay materials alone.

The loss of heat through the walls may be reduced by filling the cavity with a cellular material such as a plastics foam or by fastening to the outer, or cavity, side of the inner leaf sheets of thermally insulating material such as a porous or cellular plastics material or a fibrous material. However both these solutions to the problem of reducing heat loss suffer from the disadvantage that an additional operation is required to instal the insulating material and the additional operation would generally be performed by specialised tradesmen and not by the bricklayers or masons who construct the leaves of the walls.

Also in the case in which sheets of thermally insulating material are fastened to the outer side of the inner leaf, it is necessary to ensure that the outer leaf is not extended above a given height relative to the height of the inner leaf until the thermally insulating sheet material has been fixed in place in order to allow the tradesmen who instal the insulating material access to the outer side of the inner leaf.

The object of the invention is to provide thermally insulating masonry units which are of suitable size and weight for easy handling by a mason and which can be used to construct an exterior wall of a building loss of heat through which is reduced to an acceptable level, without the need for any additional operation to improve the thermal insulation.

Accordingly the invention provides a masonry unit comprising a cementitious portion to at least one face of which is secured a thermally insulating panel.

The cementitious portion of the masonry unit may be formed, for example, of dense concrete, lightweight concrete or aerated concrete. The most common aggregates for use in dense concrete are gravel and crushed igneous, metamorphic or sedimentary rock. Especially useful aggregates for dense concrete are crushed limestone and quartzite and the sand and gravel byproducts of china clay extraction. The aggregates used in lightweight concrete may be, for example, pumice, expanded shale, foamed slag or bloated or expanded clay. Aerated concrete is generally made by incorporating in the concrete mix a substance which will generate a gas by chemical reaction with one or more of the other ingredients of the mix. For example aluminium powder may be used which generates hydrogen by chemical reaction with the free alkali in the concrete mix or calcium carbide which generates acetylene by reaction with the water.

The cementitious portion of the masonry unit may be solid, cellular or hollow. A celular masonry unit is generally understood to be one which has cavities which do not pass completely through the unit, whereas a hollow masonry unit has cavities which pass through the unit from one face to the opposite face.

The masonry unit is conveniently formed from a concrete mix comprising from 8 to 12 parts by weight of aggregate per part by weight of Portland cement. The aggregate conveniently comprises from 30 to 70% by weight of coarse aggregate and from 70 to 30% by weight of fine aggregate. The coarse aggregate generally consists of particles not larger than 10mm, and preferably of particles in the size range from 3 to 10mm. The fine aggregate is conveniently Zone 2 or Zone 3 sand as defined by British Standard Specification No. 882;1201: Part 2:1973 "Coarse and fine aggregates from natural sources".

The thermally insulating panel is preferably of a plastics material such as expanded or extruded polystyrene. However other thermally insulating materials such as fibrous or cellular materials may be used.

When the panel is of plastics material the thickness of the panel is preferably in the range from 10mm to 75mm.

The panel may be secured to the cementitious portion of the masonry unit by means of an adhesive which may be, for example, an epoxy resin or an impact adhesive, or double-sided adhesive tape may be used for this purpose.

Alternatively the panel may be secured to the cementitious portion by means of one or more mechanical keys. Each mechanical key may comprise a tongue formed on one member of the pair consisting of the cementitious portion and the thermally insulating panel and a co-operating groove formed in the other member. The sides of the tongue and groove are preferably formed with a re-entrant portion so that the tongue and groove lock together once engaged.

A thermally insulating panel is secured to each cementitious portion when the cementitious portion has cured sufficiently to permit handling. The masonry units with their attached panels may then be arranged to form a unit load containing a predetermined number of units. The masonry units are preferably arranged so that their panels are vertical, the panels of pairs of adjacent units are juxtaposed and no panel is in an outside face of the unit load. In this way the panels are protected from damage during handling. A unit load is preferably built up from

layers of masonry units in such a way that alternate layers have the longest dimension of the masonry units orientated in mutually perpendicular directions. Advantageously the unit load is supported on a pallet and is covered with a sheet material such as, for example, a tough plastics film.

At least the two longer edges of the thermally insulating panels are preferably bevelled. Bevelled edges are advantageous because, if the panel is slightly larger than the face of the cementitious portion to which it is secured, the excess material of the panel is more easily removed to enable two adjacent masonry units to fit together closely, and also because, when two masonry units are bonded together with mortar in a wall, the mortar in the substantially V-shaped space between the bevels on the panels of the two masonry units not only bonds the masonry units together but also helps to hold the panels on to the masonry units. Advantageously the depth of the bevel across the thickness of the panel is in the range from 2mm to 5mm.

A masonry unit may have thermally insulating panels secured to two mutually perpendicular faces for use in forming corners. The panel may be firmly secured to the cementitious portion over only part of the area of one face of the cementitious portion, the remainder of the panel being held in place by, for example, spots of adhesive, to facilitate removal of part of the panel or the insertion of a damp proof membrane or other sheet material between the panel and the cementitious material.

For a better understanding of the invention, and to show more clearly how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which

Figure 1 is an isometric view of a masonry unit according to the invention;

Figure 2 is a vertical section through two masonry units superposed one upon the other with a mortar joint between the two masonry units;

Figure 3 is an isometric view of a unit load of masonry units in accordance with the invention; and

Figures 4A, 4B and 4C are sketches showing sections through three different tongue and groove joints for attaching a thermally insulating panel to a cementitious portion.

Referring to Figure 1, a panel 1 of expanded polystyrene of thickness 25mm is secured by means of an epoxy resin adhesive to a solid, dense concrete block 2 made from concrete containing 1 part by weight of Portland cement to 10 parts by weight of aggregate, the aggregate comprising 60% by weight of crushed limestone in the size range from 3mm to 10mm as the coarse aggregate and 40% by weight of Zone 2 sand prepared from crushed limestone. All four edges of the thermally insulating panel are bevelled to a depth of 3mm.

Figure 2 shows a first masonry unit 3 having a second masonry unit 4 superposed thereon and bonded thereto by a layer of mortar 5. It can be seen that, in the substantially V-shaped space 6 between the bevels of the thermally insulating panels, the mortar, when hard, helps to hold the panels in position against the masonry units.

Referring to Figure 3, a unit load 7 of forty-eight masonry units is stacked on a pallet 8 in four layers 9, 10, 11 and 12. The masonry units in layers 9 and 11 are disposed with their longest dimension perpendicular to the longest dimension of the units in layers 10 and 12 in order to improve the stability of the unit load. The masonry units are arranged in pairs panel to panel and with the panels in a vertical plane in such a way that no panel is on the outside of the unit load in order to minimise damage to the panels.

Figures 4A, 4B and 4C illustrate different types of tongue and groove joint which may be used to secure the panel to the cementitious portion. Figure 4A shows a joint in which the tongue 13 and groove 14 have a dovetail section; in Figure 4B the tongue and groove are of bulbous section; and in Figure 4C the tongue and groove have a bulbous portion 15 and a narrower straight neck portion 16. In each case the sides of the tongue and groove have a re-entrant portion so that the tongue and the groove lock together once engaged.

CLAIMS

1. A masonry unit comprising a cementitious portion to at least one face of which is secured a thermally insulating panel.

2. A masonry unit according to claim 1, wherein the cementitious portion is formed of dense concrete, lightweight concrete or aerated concrete.

3. A masonry unit according to claim 1 or claim 2, wherein the thermally insulating panel is of a plastics material.

4. A masonry unit according to claim 3, wherein the thermally insulating panel is of expanded or extruded polystyrene.

5. A masonry unit according to claim 3 or 4, wherein the thickness of the panel is in the range from 10mm to 75mm.

6. A masonry unit according to any one of claims 1 to 5, wherein the thermally insulating panel is secured to the cementitious portion by means of an adhesive.

7. A masonry unit according to claim 6, wherein the adhesive is an epoxy resin or an impact adhesive.

8. A masonry unit according to any one of claims 1 to 5, wherein the thermally insulating panel is secured to the cementitious portion by means of double-sided adhesive tape.

9. A masonry unit according to any one of claims 1 to 5, wherein the thermally insulating panel is secured to the cementitious portion by means of one or more mechanical keys.

10. A masonry unit according to claim 9, wherein each mechanical key comprises a tongue formed on one member of the pair consisting of the cementitious portion and the thermally insulating panel and a co-operating groove formed in the other member.

11. A masonry unit according to claim 10, wherein the sides of the tongue and of the groove are formed with a re-entrant portion.

12. A unit load of masonry units according to claim 1, wherein the masonry units are arranged so that the panels are vertical, the panels of pairs of adjacent units are juxtaposed and no panel is in an outside face of the unit load.

13. A unit load according to claim 12 which is

supported on a pallet.

14. A unit load according to claim 12 or 13 which is covered with a sheet material.

15. A unit load according to claim 14, wherein the sheet material is a tough plastics film.

16. A masonry unit as hereinbefore described with reference to Figure 1.

17. A masonry unit as hereinbefore described with reference to Figures 4A, 4B or 4C.

18. A unit load of masonry units as hereinbefore described with reference to Figure 3.

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